CLAIMS

What is claimed is:

1. An apparatus, comprising:

an integrated circuit die comprising a substrate having a first surface and a second surface, and integrated circuit, and a plurality of integrated circuit contacts located on the first surface and electrically connected to the integrated circuit;

a plurality of stress metal springs electrically connected to the integrated circuit contacts, the plurality of stress metal springs comprising a plurality of metal layers at least two of the metal layers having different initial levels of stress, the stress metal springs defining a loop structure which is rotated by an effective rotation angle away from the first surface of the integrated circuit; and

a polymer layer substantially covering the first surface of the integrated circuit and a portion of each of the plurality of stress metal springs, such that a portion of the loop structure of each of the plurality of stress metal springs extends beyond the polymer layer.

2. The apparatus of Claim 1, wherein the at least two of the metal layers are comprised of the same metal and have an initial stress gradient.

3. The apparatus of Claim 1, wherein each of the plurality of stress metal springs further comprises at least one plating layer which substantially covers the loop structure.

4. The apparatus of Claim 3, wherein at least one of the at least one plating layer comprises nickel.

5. The apparatus of Claim 3, wherein at least one of the at least one plating layer comprises a nickel alloy.

6. The apparatus of Claim 3, wherein at least one of the at least one plating layer comprises gold.

7. The apparatus of Claim 3, wherein at least one of the at least one plating layer comprises silver.

8. The apparatus of Claim 3, wherein at least one of the at least one plating layer comprises rhodium.

9. The apparatus of Claim 3, wherein at least one of the at least one plating layer comprises palladium.

10. The apparatus of Claim 3, wherein at least one of the at least one plating layer comprises cobalt.

11. The apparatus of Claim 1, wherein the polymer layer comprises an elastomer.

12. The apparatus of Claim 1, wherein the plurality of integrated circuit contacts comprise contact pads.

13. The apparatus of Claim 1, wherein the effective rotation angle is less than 90 degrees.

14. The apparatus of Claim 1, wherein the effective rotation angle is greater than 180 degrees.

15. The apparatus of Claim 1, wherein the effective rotation angle is approximately 270 degrees.

16. The apparatus of Claim 1, wherein the first metal layer of the plurality of metal layers of the each of the plurality of stress metal springs which is directly connected to the integrated circuit and forms the outer convex layer on the loop structure is a boundary layer.

17. The apparatus of Claim 1, wherein the boundary layer comprises gold.

18. The apparatus of Claim 1, wherein the boundary layer comprises rhodium.

19. The apparatus of Claim 1, wherein the boundary layer comprises palladium.

20. The apparatus of Claim 1, wherein the portion of the loop structure of each of the plurality of stress metal springs which extends beyond the polymer layer further comprises an expanded contact surface.

21. An apparatus, comprising:

a compliant wafer carrier substrate having a first surface and a second surface; and

a plurality of chip scale packages adhesively attached to the first surface of the compliant wafer carrier;

each of the plurality of chip scale packages comprising an integrated circuit die comprising a substrate having a first surface and a second surface, an integrated circuit device, and a plurality of integrated circuit contacts located on the first surface and electrically connected to the integrated circuit device.

22. The apparatus of Claim 21, wherein each of the plurality of chip scale packages further comprise:

a plurality of stress metal springs electrically connected to the integrated circuit contacts, the plurality of stress metal springs comprising a plurality of metal layers, at least two of the metal layers having different initial levels of stress, the stress metal springs defining a loop structure which is rotated by an effective rotation angle away from the first surface of the integrated circuit due to the different initial levels of stress, and a polymer layer substantially covering the first surface of the integrated circuit and a portion of each of the plurality of stress metal springs, such that a portion of the loop structure of each of the plurality of stress metal springs extends beyond the polymer layer.

23. An interposer, comprising:

a electrically insulative support substrate having a first surface and a second surface; and

at least one stress metal spring extending at least from the first surface to the second surface of the support substrate, each of the at least one stress metal spring comprising a plurality of metal layers, at least two of the metal layers having different levels of stress, each of the at least one stress metal spring defining a loop structure which is rotated by an effective rotation angle away from the first surface of the support substrate.

24. The interposer of Claim 23, wherein the support substrate comprises a polymer.

25. The interposer of Claim 23, wherein the support substrate comprises an elastomer.

26. The interposer of Claim 23, wherein the at least two of the metal layers are comprised of the same metal and have an initial stress gradient.

27. A process, comprising the steps of:

providing a sacrificial substrate;

establishing a plurality of metal layers on the sacrificial substrate, at least two of the metal layers having different levels of stress;

releasing a portion of the plurality of metal layers to form a non-planar loop structure which is rotated by an effective rotation angle away from the sacrificial substrate;

establishing a polymer layer over the sacrificial substrate, the plurality of metal layers, and the formed non-planar loop structure;

removing a portion of the established polymer layer to expose a portion of the formed non-planar loop structure; and

removing the sacrificial substrate.

28. The process of Claim 27, wherein the at least two of the metal layers are comprised of the same metal and have an initial stress gradient.

29. The process of Claim 27, wherein the first of the established plurality of metal layers comprises a boundary layer.

30. The process of Claim 29, wherein the boundary layer comprises gold.

31. The process of Claim 29, wherein the boundary layer comprises rhodium.

32. The process of Claim 29, wherein the boundary layer comprises palladium.

33. The process of Claim 27, further comprising the step of:

forming at least one plated layer over the non-planar loop structure.

34. The process of Claim 33, wherein at least one of the at least one formed plated layer comprises nickel.

35. The process of Claim 33, wherein at least one of the at least one formed plated layer comprises a nickel alloy.

36. The process of Claim 33, wherein at least one of the at least one formed plated layer comprises gold.

37. The process of Claim 33, wherein at least one of the at least one formed plated layer comprises rhodium.

38. The process of Claim 33, wherein at least one of the at least one formed plated layer comprises palladium.

39. The process of Claim 33, wherein at least one of the at least one formed plated layer comprises cobalt.

40. The process of Claim 27, wherein the sacrificial substrate further comprises a groove at least one groove.

41. The process of Claim 27, wherein the sacrificial substrate further comprises a groove, further comprising the step of:

filling the groove with an electrically conductive material;

wherein a portion of the plurality of metal layers is established on the electrically conductive material.

42. The process of Claim 27, wherein the established polymer layer comprises a plurality of polymer layers.

43. The process of Claim 27, wherein the effective rotation angle is less than 90 degrees.

44. The process of Claim 27, wherein the effective rotation angle is greater than 180 degrees.

45. The process of Claim 27, wherein the effective rotation angle is approximately 270 degrees.

46. A contactor, comprising:

a substrate having a first surface and a second surface, and a plurality of conductive vias extending from the first surface to the second surface;

a plurality of stress metal springs electrically connected to the vias, the plurality of stress metal springs comprising a plurality of metal layers, at least two of the metal layers having different initial levels of stress, the stress metal springs defining a loop structure which is rotated by an effective rotation angle due to the different initial levels of stress away from the first surface of the substrate, wherein each of the plurality of stress metal springs further comprises a primary plating layer which substantially covers the loop structure.

47. The contactor of Claim 46, wherein the primary plating layer comprises nickel.

48. The contactor of Claim 46, wherein the primary plating layer comprises a nickel alloy.

49. The contactor of Claim 46, wherein the primary plating layer comprises cobalt.

50. The contactor of Claim 46, further comprising a secondary plating layer over the primary plating layer.

51. The contactor of Claim 50, wherein the secondary plating layer comprises rhodium.

52. The contactor of Claim 50, wherein the secondary plating layer comprises gold.

53. A contactor, comprising:

a substrate having a first surface and a second surface, and a plurality of conductive vias extending from the first surface to the second surface;

a plurality of stress metal springs electrically connected to the vias, the plurality of stress metal springs comprising a plurality of metal layers, at least two of the metal layers having different initial levels of stress, the stress metal springs defining a loop structure which is rotated by an effective rotation angle due to the different initial levels of stress away from the first surface of the substrate; and

a polymer layer substantially covering the first surface of the substrate and a portion of each of the plurality of stress metal springs, such that a portion of the loop structure of each of the plurality of stress metal springs extends beyond the polymer layer.

54. The contactor of Claim 53, wherein the at least two of the metal layers are comprised of the same metal and have an initial stress gradient.

55. The contactor of Claim 53, wherein each of the plurality of stress metal springs further comprises at least one plating layer which substantially covers the loop structure.

56. The contactor of Claim 55, wherein at least one of the at least one plating layer comprises nickel.

57. The contactor of Claim 55, wherein at least one of the at least one plating layer comprises a nickel alloy.

58. The contactor of Claim 55, wherein at least one of the at least one plating layer comprises gold.

59. The contactor of Claim 55, wherein at least one of the at least one plating layer comprises rhodium.

60. The contactor of Claim 55, wherein at least one of the at least one plating layer comprises palladium.

61. The contactor of Claim 55, wherein at least one of the at least one plating layer comprises cobalt.

62. The contactor of Claim 53, wherein the polymer layer comprises an elastomer.

63. The contactor of Claim 53, wherein the portion of the loop structure of each of the plurality of stress metal springs which extends beyond the polymer layer comprises a contact pad region.

64. The contactor of Claim 53, wherein the effective rotation angle is less than 90 degrees.

65. The contactor of Claim 53, wherein the effective rotation angle is greater than 180 degrees.

66. The contactor of Claim 53, wherein the effective rotation angle is approximately 270 degrees.

67. A process, comprising the steps of:

providing a contactor substrate having a first surface and a second surface, and a conductive via extending from the first surface to the second surface;

establishing a plurality of metal layers on the contactor substrate in electrical contact with the via, at least two of the metal layers having different initial levels of stress;

releasing a portion of the plurality of layers to form a non-planar loop structure which is rotated by an effective rotation angle due to the different initial layers of stress away from the contactor substrate; and

forming the support substrate over the contactor substrate and partially over the formed non-planar loop structure.

68. The process of Claim 67, wherein the step of forming the support substrate over the contactor substrate and partially over the formed non-planar loop structure further comprises:

establishing the support substrate over the contactor substrate, the plurality of metal layers, and the formed non-planar loop structure; and

removing a portion of the established support substrate to expose a portion of the formed non-planar loop structure.

69. The process of Claim 67, wherein effective rotation angle is less than 90 degrees.

70. The process of Claim 67, wherein effective rotation angle is greater than 180 degrees.

71. The process of Claim 67, wherein effective rotation angle is approximately 270 degrees.

72. The process of Claim 67, wherein the first of the established plurality of metal layers comprises a boundary layer.

73. The process of Claim 72, wherein the boundary layer comprises gold.

74. The process of Claim 72, wherein the boundary layer comprises rhodium.

75. The process of Claim 72, wherein the boundary layer comprises palladium.

76. The process of Claim 67, further comprising the step of:

forming at least one plated layer over the non-planar loop structure.

77. The process of Claim 76, wherein at least one of the at least one formed plated layer comprises nickel.

78. The process of Claim 76, wherein at least one of the at least one formed plated layer comprises a nickel alloy.

79. The process of Claim 76, wherein at least one of the at least one formed plated layer comprises gold.

80. The process of Claim 76, wherein at least one of the at least one formed plated layer comprises rhodium.

81. The process of Claim 76, wherein at least one of the at least one formed plated layer comprises palladium.

82. The process of Claim 76, wherein at least one of the at least one formed plated layer comprises cobalt.

83. The process of Claim 67, wherein the contactor substrate further comprises at least one groove.

84. The process of Claim 67, wherein the contactor substrate further comprises a groove, further comprising the step of;

filling the groove with an electrically conductive material;

wherein a portion of the plurality of metal layers is established on the electrically conductive material.

85. The process of Claim 67, wherein the established polymer layer comprises a plurality of polymer layers.

86. A system, comprising:

a compliant carrier having a first surface and a second surface;

at least one integrated circuit device having a lower surface and an upper surface, the lower surface adhesively attached to the first surface of the compliant carrier, each of the at least one integrated circuit a plurality of electrical connections on the upper surface;

a system board having a bottom surface and a top surface, and a plurality of electrical conductors extending between the bottom surface and the top surface; and

a plurality of electrically conductive connections between each of the plurality of electrical connections on the upper surface of each of the at least one integrated circuit device and each of the electrical conductors on the bottom surface of the system board.

87. The system of Claim 86, wherein the plurality of electrical connections on the upper surface of each of the at least one integrated circuit device are photolithographically patterned springs.

88. The system of Claim 86, wherein the plurality of electrically conductive connections between each of the plurality of electrical connections on the upper surface of each of the at least one integrated circuit device and each of the electrical conductors on the bottom surface of the system board are stress metal springs on the upper surface of each of the at least one integrated circuit device.

89. The system of Claim 86, wherein each of the plurality of electrically conductive connections between each of the plurality of electrical connections on the upper surface of each of the at least one integrated circuit device and each of the

electrical conductors on the bottom surface of the system board are flexible spring probes on the bottom surface of the system board.

90. The system of Claim 89, wherein the flexible spring probes on the bottom surface of the system board are photolithographically patterned springs.

91. The system of Claim 86, further comprising:

a travel limit mechanism which limits perpendicular travel of each of the at least one integrated circuit device in relation to the system board.

92. The system of Claim 86, further comprising:

a pressure plate support;

wherein the second surface of the compliant carrier is supported on the pressure plate support.

93. The system of Claim 92, wherein the pressure plate support is compliant.

94. The system of Claim 86, wherein the compliant carrier is thermally conductive.

95. The system of Claim 86, wherein the compliant carrier is electrically conductive.

96. The system of Claim 86, further comprising:

at least one interface module having a plurality of electrically conductive pads on a planar region, at least one of the electrically conductive pads connected to at least one interconnection region, and at least one link connected to at least one of the at least one interconnection region; and

means for fixedly holding each of the at least one interface module in relation to the system board, such that the plurality of electrically conductive pads on the planar region of each of the at least one interface module contact at least one of the plurality of electrical conductors on the top surface of the system board.

97. The system of Claim 96, wherein each of the at least one interface module includes a circuit having a first surface and a second surface, and wherein the plurality of electrically conductive pads are located on the first surface.

98. The system of Claim 97, wherein the circuit is a flexible circuit.

99. The system of Claim 97, wherein the circuit is a semi-rigid circuit.

100. The system of Claim 97, wherein the circuit is a rigid circuit.

101. The system of Claim 96, further comprising:

at least one buss bar electrically connected to at least one of the at least one interconnection region.

102. The system of Claim 101, further comprising:

at least one power control module located on the at least one interface module, each of the at least one power control module electrically connected between the at least one buss bar and at least one of the at least one the interconnection region.

103. The system of Claim 102, wherein the at least one power control module is in thermal contact with the at least one buss bar.

104. The system of Claim 101, further comprising:

at least one power control module located on the at least one buss bar, each of the at least one power control module electrically connected between the at least one buss bar and at least one of the at least one the interconnection region.

105. The system of Claim 104, wherein the at least one power control module is in thermal contact with the at least one buss bar.

106. A process, comprising the steps of:

providing a compliant carrier having an first surface and a second surface;

adhesively attaching a wafer comprising at least one integrated circuit device lower surface and an upper surface on the first surface of the compliant carrier, each of the at least one integrated circuit having a plurality of electrical connections on the upper surface;

separating each of the at least one integrated circuit devices from the other of the at least one integrated circuit devices;

providing a system board having a bottom surface and a top surface, and a plurality of electrical conductors extending between the bottom surface and the top surface; and

creating a plurality of electrically conductive connections between each of the plurality of electrical connections on the upper surface of each of the at least one integrated circuit device and each of the electrical conductors on the bottom surface of the system board.

107. The process of Claim 106, further comprising the steps of:

providing at least one interface module having a plurality of electrically conductive pads on a planar region, at least one of the electrically conductive pads connected to at least one interconnection region, and at least one link connected to at least one of the at least one interconnection region; and

fixedly holding each of the at least one interface module in relation to the system board, such that the plurality of electrically conductive pads on the planar region of each of the at least one interface module contact at least one of the plurality of electrical conductors on the top surface of the system board.

108. The process of Claim 106, further comprising the step of:

providing a pressure plate support; and

supporting the second surface of the compliant carrier on the pressure plate support.

109. The process of Claim 108, wherein the pressure plate support is compliant.

110. The process of Claim 106, wherein the compliant carrier is thermally conductive.

111. The process of Claim 106, wherein the compliant carrier is electrically conductive.